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コーヒー中のヒドロキシヒドロキノン (HHQ)
からの過酸化水素産生と制御

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Production and its inhibition of hydrogen peroxide
from hydroxyhydroquinone (HHQ) in coffee

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【目的】コーヒー中の DNA 鎖切断成分とし
て、hydroxyhydroquinone (HHQ) を同定し、そ
の切断作用は、酸素存在下中性で活性酸素種
を発生するためであることを報告した。今
回、コーヒーに含まれるポリフェノール類の
中性における過酸化水素発生能を比較検討
し、その発生の制御について検討した。

【実験】 酸素電極を用い、中性溶液での溶
存酸素濃度の消費とカタラーゼ添加による過
酸化水素産生を検討したところ、HHQ の溶存
酸素の消費量と過酸化水素の産生量は
pyrogallol, hydroquinone, chlorogenic acid よりは
るかに多いことが分かった。蛍光法による過
酸化水素の定量を行った結果も同様であっ
た。HHQ は 0.5-0.6 当量の過酸化水素を発生
した。HHQ 溶液にはセミキノンラジカル、OH
ラジカルの生成、キノンの生成も認められ
た。HHQ による溶存酸素の消費、過酸化水素
の産生、HHQ の分解、セミキノンラジカルの
生成、キノンの生成は、Cu, Zn-, Mn-, Fe-SOD
により効率よく抑制されたことから、過酸化
水素の産生に先行してスーパーオキシドが産
生し、HHQ の自動酸化にスーパーオキシドが
触媒的に作用していることが分かった。

【結論】コーヒー中の HHQ は効率のよい過酸
化水素発生源であり、SOD は HHQ からの過
酸化水素産生を効果的に抑制することが分
かった。

Production and its inhibition of hydrogen peroxide from hydroxyhydroquinone (HHQ) in coffee

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[Object] We have already identified hydroxyhydroquinone (HHQ) as a DNA chain cleavage ingredient in coffee and reported that the cleavage effect is due to generation of active oxygen species under a neutral condition in the presence of oxygen. Here, we have compared the ability of polyphenols contained in coffee to generate hydrogen peroxide under a neutral condition and studied inhibition of its generation.

[Experiment] Using an oxygen electrode, we studied consumption of the dissolved oxygen concentration in a neutral solution and generation of hydrogen peroxide by addition of catalase, and found that the amount of the dissolved oxygen consumed by HHQ and the amount of the hydrogen peroxide generated by HHQ were far more than those of pyrogallol, hydroquinone and chlorogenic acid. The same result was obtained by quantification of hydrogen peroxide using fluorometry. HHQ generated 0.5 to 0.6 equivalent amount of hydrogen peroxide. Generation of semiquinone radical, generation of OH radical and generation of quinone were also observed in the HHQ solution. Since consumption of dissolved oxygen by HHQ, generation of hydrogen peroxide, degradation of HHQ, generation of semiquinone radical and generation of quinone were effectively inhibited by Cu, Zn-, Mn- and Fe-SOD,

it was found that superoxide is generated prior to generation of hydrogen peroxide and the superoxide catalytically affects self-oxidation of HHQ.

[Conclusion] It was found that HHQ in coffee is an effective source of hydrogen peroxide and SOD effectively inhibits generation of hydrogen peroxide from HHQ.